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# EXECUTIVE SUMMARY

## for

## Characterization of Releases to Surface Water From the Rocky Flats Plant

The Rocky Flats Environmental Technology Site is owned by the U.S. Department of Energy (DOE) and is currently contractor-operated by Kaiser-Hill Company. For most of its history, the site was called the Rocky Flats Plant (RFP) and was operated by Dow Chemical Company as a nuclear weapons research, development, and production complex. The RFP is located about 8–10 km from the cities of Arvada, Westminster, and Broomfield, Colorado and 26 km (16 mi). northwest of downtown Denver, Colorado.

Through a 1989 Agreement in Principle between the DOE and the State of Colorado, DOE provided the State with funding and technical support for health-related studies. The purpose of the Historical Public Exposures Studies on Rocky Flats was to identify potential health effects in residents in nearby communities who may have been exposed to past toxic and radioactive releases.

Phase I of the study was performed by ChemRisk (a division of McLaren/Hart, Environmental Engineering). In Phase I, ChemRisk conducted an extensive investigation of past operations and releases from the RFP. *Radiological Assessments Corporation* (*RAC*) was awarded the contract to conduct Phase II of the study, an in-depth investigation of the potential doses and risks to the public from historical releases from Rocky Flats. During Phase I ChemRisk did not develop radionuclide and chemical source term estimates for surface water releases because they could not locate continuous effluent monitoring data for all release points from the site. Instead, they evaluated water monitoring data for radioactivity in drinking water supplies from reservoirs downstream of the Rocky Flats Plant for their potential impact on offsite populations. In Phase II, the Health Advisory Panel recommended that additional characterization of the treatment and release of liquid effluents from the site.

This report documents the evaluation of the liquid effluent procedures and facilities at the Rocky Flats Plant and focuses on the early years of operations (before 1975). The methods used onsite to collect, transport and treat liquid wastes before they were discharged offsite are described. Contaminants in the plant's wastewater were released from Rocky Flats into the creeks on the Site. Even in the early 1950s, however, when the plant was built, well-defined liquid waste handling procedures were used to reduce the amount of plutonium released offsite. A special building was constructed in 1952 to process plutonium liquid wastes. All liquid wastes, containing fairly high levels of plutonium, coming directly from the plutonium processing areas were sent directly to the waste processing facility for removal of the plutonium. In the very early years, the treated wastewater was then discharged directly into the creeks. An onsite sewage treatment plant handled the site's normal liquid wastes. A more complex sewage treatment system was built in December 1974.

There were two series of ponds constructed at the site for two different purposes. The holding ponds, a series of uncovered and unlined ponds, were constructed on Woman Creek and on the north and south branches of Walnut Creek. The holding ponds provided and important measure in decreasing the levels of radioactivity in water that was released off the site. The first three holding ponds were built in the early 1950s. Eight additional ponds were added over the years. After allowing the solid material in the wastewater to settle to the bottom and after testing the water, plant officials gradually released the pond water into the creeks flowing eastward off the plant site.

The second series of ponds, called the solar evaporation ponds, were built onsite in the mid-1950s. These ponds, which served a different purpose than the holding ponds, were built in response to concern about high releases of nitrates when homes were first built in an area of Broomfield. These ponds were constructed to hold and allow the evaporation of liquids that had low levels of radioactivity but high concentrations of nitrates.

At times, these systems did not operate as effectively as they should have. Sometimes liquid wastes with some plutonium contamination drained directly into the creeks. In the 1950s, some modifications were made to reduce the amount of plutonium liquid wastes discharged directly to the creeks. However, periodic releases of untreated wastes continued until 1965 because of equipment problems and leakage.

Liquid waste from the asphalt-lined solar evaporation ponds was never intended to be released into the creeks. However, leakage sometimes occurred through cracks in the lining. Due to problems with leakage, the solar evaporation ponds were often relined with upgraded materials to prevent further releases from occurring. However, leakage from the ponds was detected at various times beginning in the 1950s. The five solar ponds have not been used to hold industrial process water since 1986. By 1996, the sludge had been removed from all the solar ponds.

The largest concentrations of plutonium flowed from Rocky Flats to the creeks during two time periods: in the early 1950s before the holding ponds were built, and from 1972–1973, when the holding ponds were drained and reconstructed. At that time, some of the pond water and sediments flowed downstream to Great Western Reservoir, a drinking water source for the City of Broomfield. In the past, the highest levels of plutonium were detected in water that went into the South Walnut Creek from the B series holding ponds. Much of the plutonium in liquid wastes settled to the bottom of the holding ponds and eventually in the sediments at the bottom of Great Western Reservoir. Levels of radioactivity in water from Walnut Creek at Indiana Street (the plant's eastern boundary) increased almost 80 times during the peak rebuilding phase. By June 1973, the radioactivity levels had returned to pre-pond reconstruction levels.

The report briefly reviews the analysis of waste water for uranium, after 1971 when uranium-specific measurements were made. After that time, the highest measured annual concentrations of uranium were measured in the A ponds (2–11 pCi $L^{-1}$) and B ponds (1–7 pCi $L^{-1}$) on Walnut Creek, which drained into the GWR. The C ponds on Woman Creek, which drained into Standley Lake, had the lowest concentrations of uranium during this period (0.5–5 pCi $L^{-1}$).

Tritium was released accidentally from the plant on several occasions when tritium-contaminated scrap plutonium was processed. The greatest amounts were released to surface water in April 1973, when wastewater containing tritium flowed into Walnut Creek leading to Great Western Reservoir. The highest tritium concentrations measured in the reservoir during this time were about two to 20 times higher than normal.

Overall, the risk to the public was small from releases of contaminants from Rocky Flats into surface water. Analysis of releases of contaminants to surface water shows that the 1973 tritium

release was the major contributor to risk for the surface water pathway. Following the tritium release in 1973, urine samples were taken from 36 people who lived or worked in Broomfield, and drank water from the reservoir. The average tritium concentration for these people was about seven times higher than normal (4,300 picocuries per liter versus 600 picocuries per liter). Three years after the release, urine samples were again taken from the same group; results indicated that their tritium concentrations were back to normal.